Small Business Innovation Research/Small Business Tech Transfer

Intelligent, Autonomous Spacecraft Operations Management System, Phase I

Completed Technology Project (2018 - 2019)

Project Introduction

MAESTRO (Management of manned spacecraft operations through intelligent, AdaptivE, autonomouS, faulT identification and diagnosis, Reconfiguration/replanning/rescheduling Optimization) substantially leverages previous NASA investments to assemble the correct set of technologies to implement all aspects of the intelligent, semi-autonomous spacecraft operations manager. We have significant experience in all of the required technologies and have already integrated them into a general MAESTRO architecture designed to be easily applied to all spacecraft subsystems.

The eventual, ultimate goal is the ability of astronauts and a semi-autonomous, intelligent onboard system to easily manage all spacecraft operations through the development of MAESTRO, which can easily interface to the various systems of a variety of spacecraft. MAESTRO must be sufficiently powerful, general, and computationally efficient and be easily adapted by developers. This will be accomplished using open standards, clearly defined open interfaces, use of Open Source software, and leveraging several previous NASA investments.

The Phase I research goals are to explore the various spacecraft subsystem domains, elaborate the AI techniques useful for subsystem characterization, diagnosis, and replanning/rescheduling/adaptive execution/safing, prove the feasibility of these techniques through prototype development, and develop a complete system specification for the Phase II MAESTRO system.

Anticipated Benefits

Because it will be an open system that other developers could use to create intelligent spacecraft operations management systems, many MAESTRO applications can be quickly developed. Since MAESTRO is specifically designed to easily interface with Diagnosis, Adaptive Execution, Planning, and Scheduling engines, developers will have their choice. There is a potential to move most spacecraft operations decision-making to onboard autonomous agents and/or the crew.

We already sell Aurora to private companies, with total sales over $13 million. MAESTRO improvements can be readily incorporated into Aurora and sold through existing sales channels, especially to the power generation industry, which we are already pursuing. There exist a large number of other applications that MAESTRO could be readily adapted to, such as oil refineries, factories, etc.

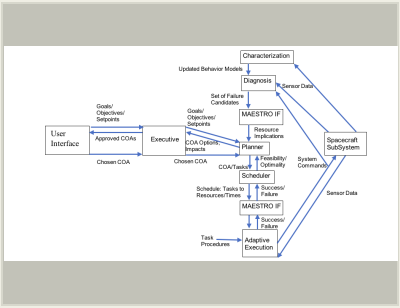

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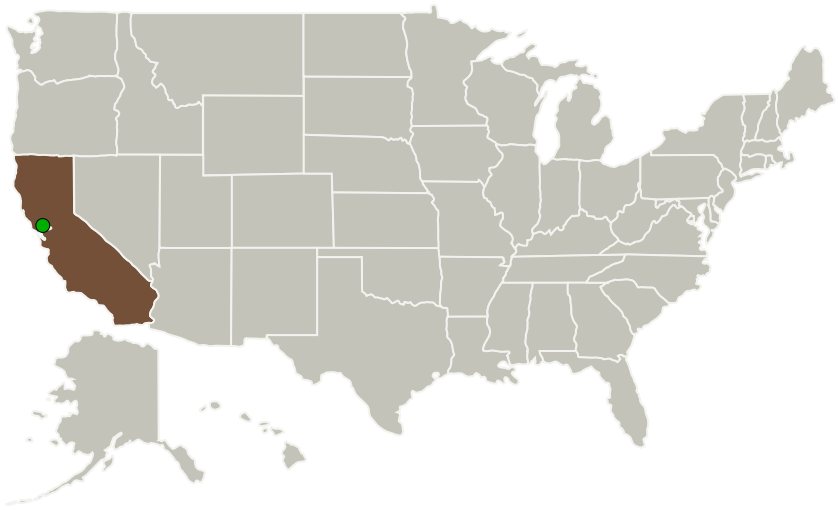
Table of Contents

Intelligent, Autonomous Spacecraft Operations Management System, Phase I

Completed Technology Project (2018 - 2019)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Stottler Henke Associates, Inc.	Lead Organization	Industry	San Mateo, California
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations
California

Project Transitions

July 2018: Project Start

February 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/141131)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Stottler Henke Associates, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Richard R Stottler

Co-Investigator:

Richard Stottler

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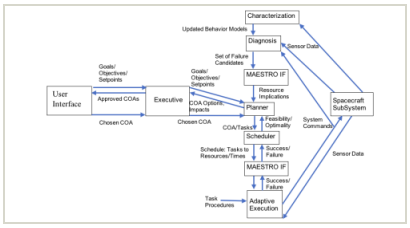
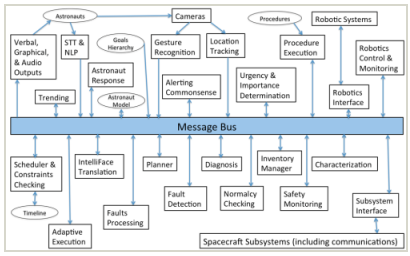
Images



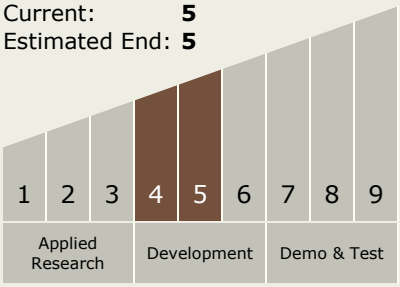
Briefing Chart Image
Intelligent, Autonomous Spacecraft Operations Management System, Phase I
(https://techport.nasa.gov/image/128345)



Final Summary Chart Image
Intelligent, Autonomous Spacecraft Operations Management System, Phase I
(https://techport.nasa.gov/image/135609)

Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.4 Environmental Monitoring, Safety, and Emergency Response
    - TX06.4.2 Fire: Detection, Suppression, and Recovery

Target Destinations

The Moon, Mars, Earth